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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/626,106	07/26/2000	Takafumi Morimoto	TPO-13	8044

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EXAMINER	
SOUW, BERNARD E	

ART UNIT	PAPER NUMBER
2881	

DATE MAILED: 05/06/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/626,106	MORIMOTO ET AL.	
	Examiner	Art Unit	
	Bernard E Souw	2881	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *RCE filed 2/12/2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *2-20 and 22-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *2-20 and 22-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *26 July 2000* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed 02/12/2004 in this application after Advisory Action mailed 02/02/2004. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 12/08/2003 (After Final Amendment) has been entered.

Notice of Appeal

2. A Notice of Appeal was filed 09/12/2003, prior to the Advisory Action mailed 02/02/2004 and the RCE filed 2/12/2004. Therefore, this RCE is considered as a replacement for the Notice of Appeal, which is assumed to be automatically withdrawn.

After Final Amendment Entered

3. The After Final Amendment A filed dated 11/14/2003 has been entered.

Claims 1 and 21 have been cancelled.

Pending in this Office Action are claims 2-20 and 22-24.

The present Office Action is made with all the suggested amendments being fully considered.

Claim Rejections - 35 U.S.C. § 103(a)

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 2, 8, 12, 14, 15, 19, and 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hosaka et al. (USPAT 5,436,448, hereinafter denoted as Hosaka-448), in view of Kajimura et al. (USPAT 5,394,741, hereinafter denoted as Kajimura-741) and Gamble (USPAT 5,811,802).

Hosaka-448 discloses a scanning probe microscope (SPM) as illustrated in Figs.1, 5 and 6, and recited in the relevant parts of the specification, comprising:

- a cantilever 1 having a probe 17 close to the surface of a sample 2, as recited in Col.10/ll.49-60;
- an actuator 14 in combination with actuator 15 provided with the cantilever 16 for changing a distance between the probe 17 and the sample 2, as recited in Col.11/ll.1-10 and Col.11/ll.22-35;
- a displacement detection system consisting of mirror (point of intersection of laser beams 18 & 19 on cantilever 1), laser light source 3, and position sensor 4, for detecting displacement of the probe 17, as recited in Col.10/ll.61-68, Col.11/ll.1-10 & 22-35; and
- a servo controller 9 outputting a control signal 2000 for controlling the operation of the actuator 14 based on a detection signal 4-5-8, as recited in Col.10/ll.61-68 and Col.11/ll.1-9, relating to a reference distance and holding a distance between the probe

and the sample at this reference distance in measurement at a sampling position, as expressly recited in Col.11/ll.7-9; wherein the probe 17 scans the surface of sample 2 to measure the surface, as disclosed in Col.11/ll.9-10, while holding the distance between the probe 17 and the sample 2 at the reference distance associated with the detector output signal 4-5-8 recited above (Col.11/ll.7-9), at each plurality of a plurality of sampling positions (X,Y), as recited in Col.11/ll.1-3 and Col.12/ll.38-45;

- an approaching and separating means shown in Fig.5, as explicitly recited in Col.14/ll.3-61, for controlling the operation of the actuator 14 (through the servo controller 9) so as to make the probe 14 approach to the sample surface 12 for measurement at each of the sampling points, as recited in Col.10/ll.63-65 already mentioned above, and then make the probe 14 separate from the sample surface, as is inherent in the operation of any SPM device; wherein the periodic pulse signal from the approaching and separating signal supplier is added to the signal relating to the reference distance produced by the servo controller, as recited in Col.14/ll.13-22 and shown in Fig.6 by the input signal V_3 to the servo circuit 9 in Fig.5, which includes an additional signal $V_1>V_2$ for driving the probe 17 to touch the specimen surface, prior to pulling back to a reference position (indicated by position 3 in Fig.2) given by voltage level V_2, which is determined by the servo circuit 9 based on the laser-detection signal 4-5-8 as depicted in Fig.1 and recited in Col.10/ll.61-68 and Col.11/ll.1-9, relating to holding the distance between the probe and the sample at a reference distance, as specifically recited in Col.11/ll.7-9; and wherein the state of the servo control by said servo controller 9 is continued at least when said probe is made to approach the sample

surface and during measurement at sampling points, as shown by the timing chart shown in Fig.6 of the signal produced by servo controller 9, as recited in Col.14/ll.23-61, thereby keeping the probe 17 and the surface of the specimen 2 equidistant, as recited in Col.11/ll.1-10.

Hosaka-448's servo signal waveform shown in Fig.6 may be different than Applicant's waveforms shown in Fig.2 or Fig.5. However, such waveforms are not recited in any of Applicant's claims. Although specific waveforms shown in Applicant's Fig.2 or Fig.5 are understood as examples or embodiments in the specification, they were not claimed explicitly. Nor were the words that are used in the claims defined in the specification to require these limitations. A reading of the specification provides no evidence to indicate that these limitations must be imported into the claims to give meaning to disputed terms. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

However, Hosaka-448's actuator 14 is not provided with the cantilever 1, but its effect is combined with actuator 15, the latter being attached to the cantilever 1.
Kajimura-741 et al. disclose a scanning probe microscope (SPM) as illustrated in Figs.1, 7, 9 and 10, and recited in the relevant parts of the specification, showing an actuator 20 provided with the cantilever 16 for changing a distance between the probe 14 and the sample 12, as recited in Col.5/ll.12-18;

It would have been obvious to one of ordinary skill in the art at the time of the invention to adopt Kajimura-741's teaching and attach both of Hosaka-448's actuators 14 and 15 on the cantilever 1 to form an equivalent of Kajimura-741's actuator 20, since

for Hosaka-448's probe 17 to approach and separate from the surface of specimen 2, it does not matter whether the Z scanner is placed beneath the specimen, or attached to the cantilever 1, as in Kajimura-741's.

Hosaka-448's as modified by Kajimura-741's does not specifically recite that the apparatus is capable of quickly performing wide measurement defined by a millimeter-class scan area. However, such a capability is conventional for a most SPMs, as disclosed by Gamble in Col.1/ll.25-29. Therefore such capability must be either already inherent in Hosaka-448's and/or Kajimura–741's, or can be easily made by one of ordinary skill in the art using only routine skill in the art, e.g., by Gamble himself.

► Claim 8 is a method claim reciting steps closely associated with the specific limitations of apparatus claim 1. Therefore, claim 8 is rejected under the same reasons over the same prior arts as previously applied to claim 1.

► Claims 14, 19 and 22 recite limitations essentially similar to those of claim 1. Therefore, claims 14, 19 and 22 are rejected under the same reasons over the same prior arts as previously applied to claim 1.

► Claims 12 and 15 recite the limitation of probe scan over millimeter-class scan area and/or millimeter units of length, which is already included in the limitation of the rejected claims 2 and 14.

► Regarding claim 23, the additional limitation of an actuator made of piezoelectric material is rendered obvious by Hosaka-448 in Col.11/ll.1-4 and by Kajimura-741 in Col.5/ll.14-15.

5. Claims 7, 9, 13, 20 and 21 are also rejected under 35 U.S.C. 103(a) as being unpatentable over Hosaka-448 in view of Kajimura-741 and Gamble.

► Regarding claims 7 and 13, the limitation of a probe having an aspect ratio "more than 5" not only are inherent in both Hosaka-448's, Kajimura-741's, and Gamble's, but furthermore, would not lend any patentability to the respective claims, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable range involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

Generally, limitations relating to the dimension of a claimed device or step is not sufficient to patent ably distinguish over the prior art. *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955).

Mere scaling up of a prior art process capable of being scaled up would not establish patentability in a claim. *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976), 531 F.2d at 1053, 189 USPQ at 148. In this regard, scaling up of the scan range of the prior art SPM device and the aspect ratio it can handle, are possible and also well known in the art.

► Regarding claim 9, Hosaka-448's method of SPM includes an additional step of adding a signal V_4 shown in Fig.6 used for the approach and separation produced by a Z-drive (part of 14 in Fig.1) to the signal appropriate to make the output of detector 4 which relates to the reference distance between the probe and the sample, as recited in Col.10/ll.61-68 & Col.11/ll.1-10. The adding step is here performed by the adding circuit 27 of servo 9, as shown in Fig.5 and recited in Col.14/ll.23-61.

Alternatively, Kajimura-741's method of SPM includes an additional step of adding a signal used for the approach and separation produced by an auxiliary Z-drive (not shown but recited in Col.7/ll.9-19) to the signal appropriate to make the output of detector 34 (or 36) equal to Pa shown in Fig.6, which relates to the reference distance between the probe and the sample, as recited in Col.6/ll.50-66. The adding step is here performed by the Z-scan of the XYZ scanner driven by servo 38, as recited in Col.7/ll.16-43.

► Regarding claim 20, the additional limitation of holding the approach-separate voltage in a separation state when moving from one sampling position to a next sampling position, is conventional and also inherent to both Hosaka-448's and Kajimura-741's.

► Regarding claim 21, the additional limitation that the approach-separation voltage signal output is a periodically generated pulse signal is conventional and also inherent to both Hosaka-448's and Kajimura-741's, as is obvious in Fig.6 of Hosaka-448's and Fig.6 of Kajimura-741's.

6. Claims 3, 4, 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hosaka-448 as modified by Kajimura-741 and Gamble, as applied to claims 1 and 8 above, and further in view of Hosaka et al. (USPAT 5,467,642, hereinafter denoted as Hosaka-642).

Hosaka-448 as modified by Kajimura-741 and Gamble recites all the limitations of claims 3, 4 and 10 as applied to claims 1 and 8 above, including that Kajimura-741's

actuator 20 is made of a piezoelectric material, as recited in Col.5/ll.12-15, except the recitation of a displacement meter for measuring the displacement made by the piezoelectric element.

Regarding claim 3, Hosaka-642's probe 17 is set along the Z-axis by a piezoelectric inchworm 31, as recited in Col.4/ll.7-10. It is well known in the art that an inchworm is conventionally equipped with a displacement meter that enables a direct reading of the amount of displacement due to expansion and contraction of the piezoelectric element 31.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use an inchworm that directly gives the amount of displacement due to expansion and contraction of the piezoelectric element, in order to be able to measure displacements independent from the instantaneously applied voltage.

The motivation to use a displacement meter is already implicated by Kajimura-741 in another embodiment of their invention, in which an additional rough z-movement mechanism is provided, as recited in Col.10/ll.51-55. Since this rough z-movement mechanism is decoupled from the instantaneous voltage applied through the controller circuit, one of ordinary skill in the art would be advised to use an inchworm, in order to directly obtain the amount of displacement.

Regarding claims 4 and 10, Hosaka-642's actuator is comprised of a first piezoelectric element 47 shown in Fig. 5 and 6 for normal measurement, as recited in Col.9/ll.29-33, and a second piezoelectric element 31 for extension and extraction, as recited in Col.9/ll.42-45 and Col.10/ll.7-8. Hosaka-642's SPM further comprises:

a signal output from the servo controller (consisting of driver 48, servo circuit 9 and deflection detection circuit 5) is given to the first piezoelectric element 47; and

- a periodic pulse signal for approach and separation is given to the second piezoelectric element 31, as already addressed in the above rejection of claim 2.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kajimura-95's SPM by Hosaka-642's two separate piezoelectric elements, since such a decoupling of the second piezoelectric element from the first one would enable the SPM perform a longer approaching & separating z-distance.

Hosaka-642's purpose of using the first piezoelectric element may be different than Applicant's. However, it has been held that a recitation with respect to the manner in which a claimed apparatus, including its individual parts, is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. *Ex parte Masham*, 2 USPQ 2d 1647 (1987).

Instead of using the first piezoelectric element 47 for correction due to probe deformation, as in Hosaka-642's, one would have been motivated to use it for a reference distance to keep the contact pressure between the probe and sample constant, as implicated by the voltage V_f in Hosaka-642's Fig.3(c), since here a correction for probe deformation is considered unnecessary (see above rejection of claim 2).

7. Claims 5, 6, 11, 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hosaka-488 in view of Kajimura-741, Gamble, and Hosaka-642, as applied to claims 4 and 8 above, and further in view of Hosaka et al. (USPAT 5,162,653, hereinafter denoted as Hosaka-653).

Hosaka-488 as modified by Kajimura-741 and Gamble and further modified by Hosaka-642, discloses all the limitations of claims 5, 6, 11, 16 and 17, as applied to claims 4 and 8 above, except the recitation of a separately provided auxiliary movement mechanism to make the probe move in tandem at an equal speed in the same direction as the scan motion.

As a matter of fact, this limitation is conventional and well-known in the art as being necessary to avoid friction along the scan direction due to relative probe-sample motion during a high speed height profile measurement, in which the x-y scan is not intermittent, but proceeds in a continuous manner. This provision of such an auxiliary and additional x or y scanning mechanism is rendered obvious by Hosaka-653 et al., showing in Fig.3 a probe tip 2 which is attached to a X-piezo 6 and Y-piezo 7, which enables both X- and Y-scanning in addition to a Z-movement provided by Z-piezo 1, as recited in Col.4/ll.1-2.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the SPM previously suggested by Hosaka-488 as modified by Kajimura-741, Gamble and Hosaka-642's, further by adding a X-scan and Y-scan piezoelectric element(s) as taught by Hosaka-653 et al., and finally, by moving Hosaka-642's probe and Hosaka-653's X-scanner 14 in the same direction, to avoid

friction along the scan direction due to relative probe-sample motion during a high speed height profile measurement, in which the x-y scan is not intermittent, but proceeds in a continuous manner.

It would have been desirable to make the steps of approach and separation during movement between sample positions, since it would save scan-time during a wide scan-area.

8. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hosaka-488 as modified by Kajimura-741, Gamble, Hosaka-642 et al. and Hosaka-653, as applied to claim 16 above, and further in view of Okada et al. (USPAT 5,289,004).

Hosaka-488 as modified by Kajimura-741, Gamble, Hosaka-642, and Hosaka-653 disclose all the limitations of claim 18, as applied to claim 16 above, except the limitation of a reverse scan motion performed each time a scan motion for tandem movement ends.

Okada et al. disclose a SPM very similar to Hosaka-488's, Kajimura-741's, Gamble's, Hosaka-642's and Hosaka-653's, with the X-scan performed by piezoelectric actuator 2 shown in Figs.1,2,4 and 6 according to a voltage signal shown in Fig.8 curve b, as recited in Col.10/ll.46-52.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the SPM previously suggested by Hosaka-488 as modified by Kajimura-741, Gamble, Hosaka-642 and Hosaka-653, further by performing a reverse X-scan as suggested by Okada et al. each time a scan motion for tandem

movement ends, since that is the most simple and direct way to increase the accuracy and reproducibility of SPM measurement by taking an average of multiple series of data.

One of ordinary skill in the art would have been motivated to adopt Osaka's teaching of a simple reverse X-scan, since to obtain a highly accurate and highly reproducible data by simple means is generally desirable in every type of measurement.

Response to Applicant's Arguments

9. Applicant's arguments filed 11/12/2003 have been fully considered. The following is the Examiner's response.

The After Final Amendment primarily introduces the additional limitation of "*quickly performing wide measurement defined by a millimeter-class scan area*", whereby the emphasis is on "*millimeter-class scan area*" allegedly not specifically recited by all prior arts previously applied. However, as recited above, this particular limitation is evidenced by Gamble as being conventional, since it was recited in the section Background of the Invention as a general property, feature, or capability of a Scanning Probe Microscopy, and hence, must be already inherent in all of the previously applied prior arts without the wording "*millimeter-class scan area*" being specifically recited. Therefore, all claims are rejected on the same grounds as previously applied in the previous Final Rejection.

Communications

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bernard E Souw whose telephone number is 571 272 2482. The examiner can normally be reached on Monday thru Friday, 9:00 am to 5:00 pm..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John R Lee can be reached on 571 272 2477. The central fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306 for regular communications as well as for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308 0956.

bes
April 17, 2004

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